

Linking Altered Volcanic Textures to Mineralization: A Case Study From the Magdalena VHMS Deposit, Iberian Pyrite Belt, Spain

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Volcanogenic hosted massive sulfide (VHMS) deposits are major sources of base, critical, and precious metals. Their formation reflects a wide range of geological settings that control metal accumulation, distribution, and preservation. In recent years, whole rock geochemistry has become an increasingly effective exploration tool contributing to new discoveries. However, a robust understanding of depositional systems remains essential to refine targeting strategies and improve exploration success.

The Iberian Pyrite Belt is a world-class VHMS province hosted by a deformed bimodal volcano-sedimentary complex. This complex records the interplay between volcanism, sedimentation, and hydrothermal processes that led to the formation of numerous polymetallic deposits in the region. Despite extensive study, the detailed controls on ore formation and preservation at the deposit scale remain an active area of research.

The Magdalena Cu–Zn–Pb deposit provides an opportunity to investigate these controls in detail. The orebody is hosted between two compositionally similar rhyolitic units: (1) a quartz–feldspar–phyric coherent rhyolite and (2) a rhyolitic volcaniclastic unit. The contrasting textures and permeability of these units likely played a key role in fluid flow, metal transport, and sulfide deposition.

This study integrates whole-rock geochemistry with the analysis of volcanic textures in an altered and deformed environment to better constrain the relationship between host rock characteristics and mineralization. By linking lithogeochemical signatures with volcanic textures, we aim to improve vectoring tools and contribute to a more comprehensive genetic model for VHMS deposits in provinces such as the Iberian Pyrite Belt. These insights ultimately support more effective exploration targeting in complex, deformed volcanic terrains.